Berkeley Storage Manager (BeStMan)

Scientific Data Management Research Group
Computational Research Division
Lawrence Berkeley National Laboratory

https://twiki.grid.iu.edu/bin/view/Management/BestmanReview

LBNL SDM group efforts for OSG

- **BeStMan Support**
  - **VO sites**
    - **US ATLAS, US CMS, STAR, and others such as LIGO, SBGRID, CERN EOS, etc.**
    - **Support areas**
      - **Deployment and configuration**
      - **Scalability/performance**
      - **Compatibility/interoperation with dCache**
      - **General SE (storage and file system) needs**
  - **User support**
    - **SRM client usage with BeStMan**
      - **e.g. lcg-utils, FNAL SRM clients (srmcp), bestman srm clients (srm-copy)**
    - **Data replication middleware**
      - **e.g. FTS, PhEDEx**

- **VO-requested feature addition and maintenance**
  - **Collaboration with bestman development team at LBNL/SDM**

- **Ref: OSG GOC tickets** https://ticket.grid.iu.edu/goc/navigator

- **Ref: BeStMan Release CHANGES file**
  https://codeforge.lbl.gov/plugins/scmsvn/viewcvs.php/bestman2-server-src/CHANGE?root=bestman&view=markup

OSG BeStMan deployments

- **OSG deployments as of Mar. 3, 2011**
  - **Number of sites providing Storage Elements: ~57**
    - **Unofficial OSG statistics based on BDII information**

- **Recent version release on Sep. 6, 2011**
  - **BeStMan2 v.2.1.2 and BeStMan v.1.3.26**
  - **Ref: CHANGES file**
    https://codeforge.lbl.gov/plugins/scmsvn/viewcvs.php/bestman2-server-src/CHANGE?root=bestman&view=markup

BeStMan Source availability

- **Source codes under BSD with Grant-back provision**
  - **Available via SVN: https://codeforge.lbl.gov/projects/bestman/**
    - **Official LBNL source code public repository, maintained by Berkeley Lab**
  - **Binary package (tar.gz file with configure) also available**
  - **All Java codes: Total 199,761 lines as of 9/6/2011**

- **Plug-in source codes**
  - **For load balancing on transfer server lists**
  - **Maintained as source and a simple package**
  - **Available via SVN
    https://codeforge.lbl.gov/projects/bestmancontrib/**

- **OSG VDT package with pacman for bestman release**

- **OSG RPM package for bestman2 release**

Documentation

- **BeStMan server administrative guide**
  - **https://sdm.lbl.gov/wiki/Software/BeStMan/BeStMan2Guide/**
- **BeStMan server plugin customization guide with code samples**
  - **https://sdm.lbl.gov/wiki/Software/BeStMan/BeStMan2Guide/Customize**
  - **Notes on scalability**
    - **https://sdm.lbl.gov/wiki/Software/BeStMan/BeStMan2Guide/ScalabilityNotes**
- **BeStMan server FAQ**
  - **https://sdm.lbl.gov/wiki/Software/BeStMan/BeStMan2Guide/BeStMan2FAQ**
- **BeStMan SRM Clients user guide**
  - **https://sdm.lbl.gov/wiki/Software/SRMClients/BeStManClientsGuide/**
  - **https://sdm.lbl.gov/wiki/Software/SRMTester/SRMTesterGuide/**
  - **https://sdm.lbl.gov/bestman/docs/srmapi/**

External Software Dependency – BeStMan server

- **Oracle/SUN JDK 1.6.0_27**
- **Apache ant 1.7.0**
- **Axis 1.4**
- **WSDL4j-1.6.2**
- **Xerces-2.9.1**
- **Jetty 7.1.5.v20100705**
- **Java CoG 1.8.0**
- **Java Servlet 2.5**
- **Slf4j-1.6.0**
- **Berkeley DB 4.0.103**
- **concurrent lib 1.3.4 from SUNY-Oswego**
- **which4j**
- **glite-security lib**

- **opensaml 1.0.1**
- **privilege 1.0.1.3**
- **vomsjapi 1.9.10**
- **commons lang 2.1**
- **commons collections 3.2**
- **joda-time 1.5.2**
- **opensaml 2.2.1**
- **privilege-xacml 2.2.4**
- **velocity 1.5**
- **Xalan 2.7.1**
- **XML-security 1.4.1**
- **Bouncy Castle crypto lib 1.3.9**

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External Software Dependency – BeStMan SRM clients

- **Oracle/SUN JDK 1.5.0_12**

- **Apache ant 1.7.0**

- **Axis 1.4**

- **WSDL4j-1.6.2**

- **Xerces-2.9.1**

- **Java CoG 1.8.0**

- **BeStMan2-2.x.x**

External Software Dependency – Maintenance

- **Security maintenance**
  - **Currently there is no known-security issues.**
- **Communication layers on external dependent software.**
  - **Mainly GSI and Jetty**
- **Frequently checked releases for an update**
  - **Especially for security vulnerability**
  - **Dependent software are being updated**
  - **BeStMan server/clients are being tested for compatibility.**

BeStMan2 RPM release

- **8 RPM packages**
  - **bestman2-common-libs**
  - **bestman2-server**
  - **bestman2-server-libs**
  - **bestman2-server-dep-libs**
  - **bestman2-client**
  - **bestman2-client-libs**
  - **bestman2-tester**
  - **bestman2-tester-libs**
- **RPMs are all built from the source release.**

Future support items

- **OpenJDK support, Java 1.7 support**

- **Transition to https layer from the current httpg**
  - **Collaboration with EMI**
  - **Implementation**
  - **Interoperation**
  - **Compatibility**
  - **Transition**

Berkeley Storage Manager (BeStMan)

- **SRM v2.2 implementation – OGF standard (Aug. 2009)**
  - **interoperable and compatible to other implementations**
- **Works on existing storages with posix-compatible file systems**
  - **NFS, GPFS, Lustre, HPFS, XroodFS, PVFS, PNFS, HFS+, …**
  - **Adaptable to special file systems and storages with customized plug-in**
    - **Site-specific customization on the file system i/o mechanism**
    - **Plug-in extension for external archival storage systems**
    - **E.g. MSS such as HPSS, REDDnet**
- **Supports multiple transfer protocols**
  - **GridFTP, FTP, HTTP/S**
- **Load balancing for multiple transfer servers**
  - **Also, supports customized plug-in for transfer server selection with custom policy**

BeStMan

- **Supports multiple storage partitions**
  - Supports pre-defined static space tokens
  - Supports space reservation
- **Supports Gateway Mode for faster performance**
  - Jetty based web server container
    - Better performance in http connection handling
    - Scalable and configurable for heavier load
  - Scales well with some file systems and storages, such as Xrootd and Hadoop
- **Authentication and authorization**
  - Supports grid-mapfile
  - Supports GUMS server – SAML and XACML based
  - Supports limited access to the underlying file system
    - User access restriction to certain directory paths
  - Supports limited permissions on file access
   - User access control to files by owners/creators only

BeStMan

- ## As data movement broker

  - BeStMan manages multiple file transfers without user intervention when a request for large scale data movements of thousands of files is submitted.
    - Recovers from transient failures
    - Supports recursive directory transfer requests
    - Supports asynchronous status check
  - BeStMan verifies that enough storage space exists for file transfer requests
  - File movements from/to remote SRMs or GridFTP servers
  - E.g. STAR use case for data movements from NERSC/PDSF to BNL

BeStMan SRM Clients

- **Supports all interfaces in SRM specification**
    - Interoperable and compatible to other SRM server and client implementations
    - Supports multiple transfer protocols
- **Added functionality**
    - User friendly command options
        - E.g. srm-copy –mkdir
          creates recursive directories before transferring files into the target
        - E.g. srm-copy –nooverwrite
          avoids duplicate transfers when target file exists.
        - E.g. srm-copy –gatewayfriendly
          skips some redundant SRM calls for BeStMan Gateway.
          Works only for BeStMan Gateway mode.
    - Supports 3rd party gridftp file transfers
    - Supports a bulk request
        - To reduce the load on the server, many single calls to SRM PUT requests are bundled together as one single request with many files in the request using –f option.
    - Available SRM Java API
    - Available SRM-Tester

BeStMan Design

- **Java implementation of SRM specification v2.2**

- **Designed to work with unix-based disk systems**

- **Adaptable to other file systems and storages via plugin mechanism**

- **MSS support to stage/ archive from/to its own disk**

- **Uses in-memory database (BerkeleyDB) for full mode**
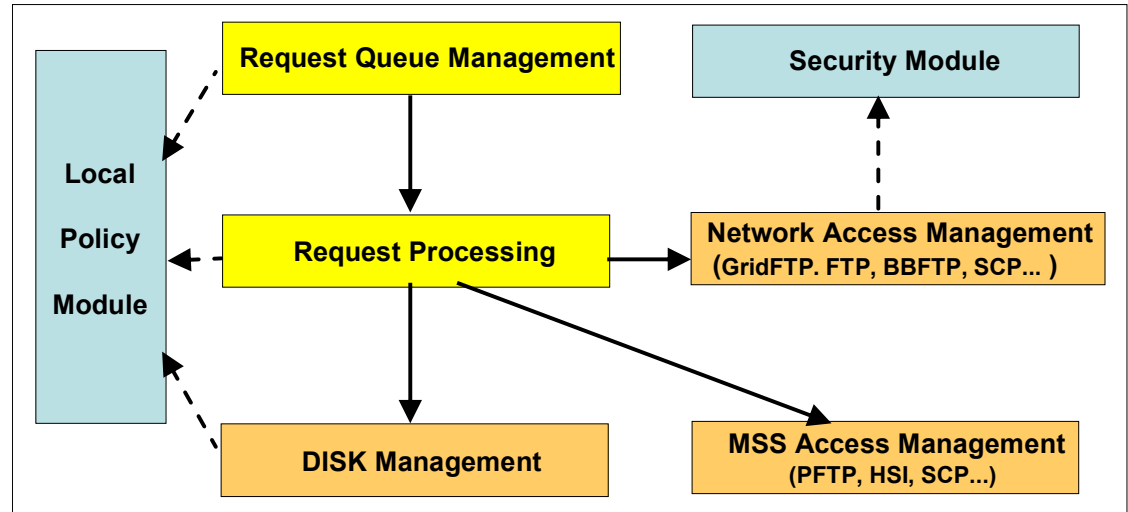
- **Multiple transfer protocols**
- **Space reservation**
- **Directory management (no ACLs)**
- **Can copy files from/to remote SRMs or GridFTP Servers**
- **Can copy entire directory recursively**
  - **Large scale data movement of thousands of files**
  - **Recovers from transient failures (e.g. MSS maintenance, network down)**

- **Local Policy**
  - **Fair request processing**
  - **File replacement in disk**
  - **Garbage collection**

- **Reference: https://sdm.lbl.gov/bestman/docs/SRM-LBNL-BeStMan-design-031201.pdf**

Use case: BeStMan Gateway + Disk storage
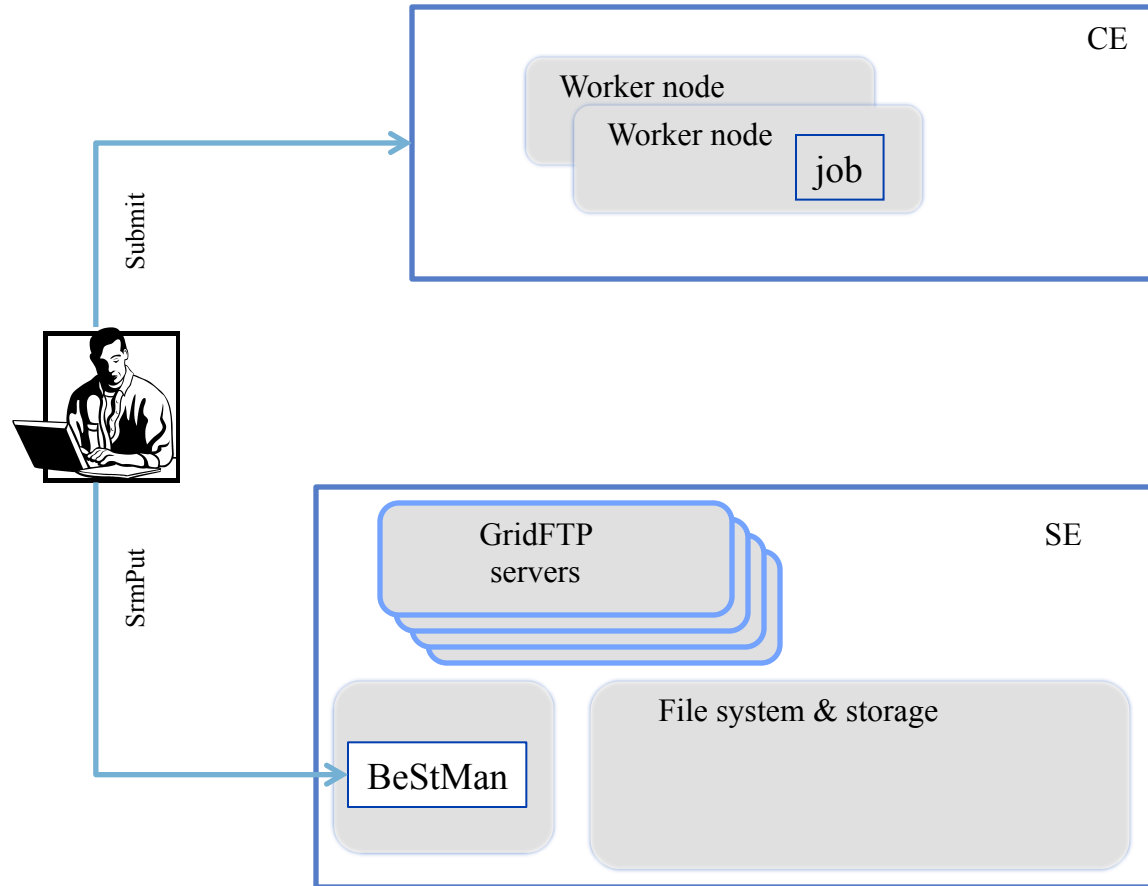
Image courtesy: Tanya Levshina

Use case: BeStMan Gateway + HDFS

CE

Worker node

Worker node

fuse

job

Submit

SrmPut

SE

GridFTP
HDFS plugin

Name Node

NameServer

Data Node

Data Node

BeStMan

fuse

Image courtesy: Tanya Levshina

Image courtesy: Tanya Levshina

1. Client submits analysis job
2. Client jobs get created on the worker nodes, and create files
3. Jobs contact local bestman
   to move the result files to the remote storage repository
4. Client jobs (using bestman client) stage files into
   bestman managed locak disk cache via TURL

5. Client jobs (using bestman client) notify bestman
   for file staging completion
6. Local bestman contacts remote storage sites
7. Bestman transfers files to the remote sites via GridFTP
8. Client jobs check the status of the file transfers results
9. Client jobs finish upon successful status status

Summary
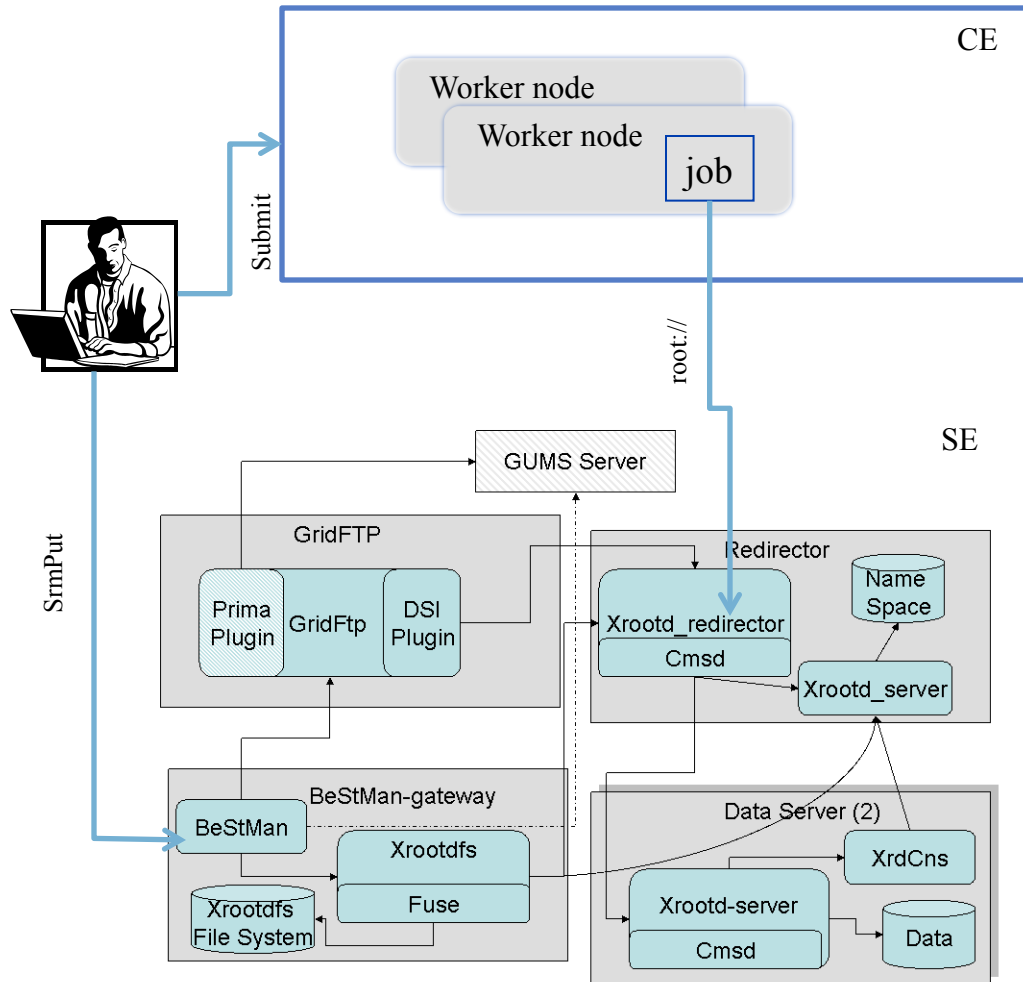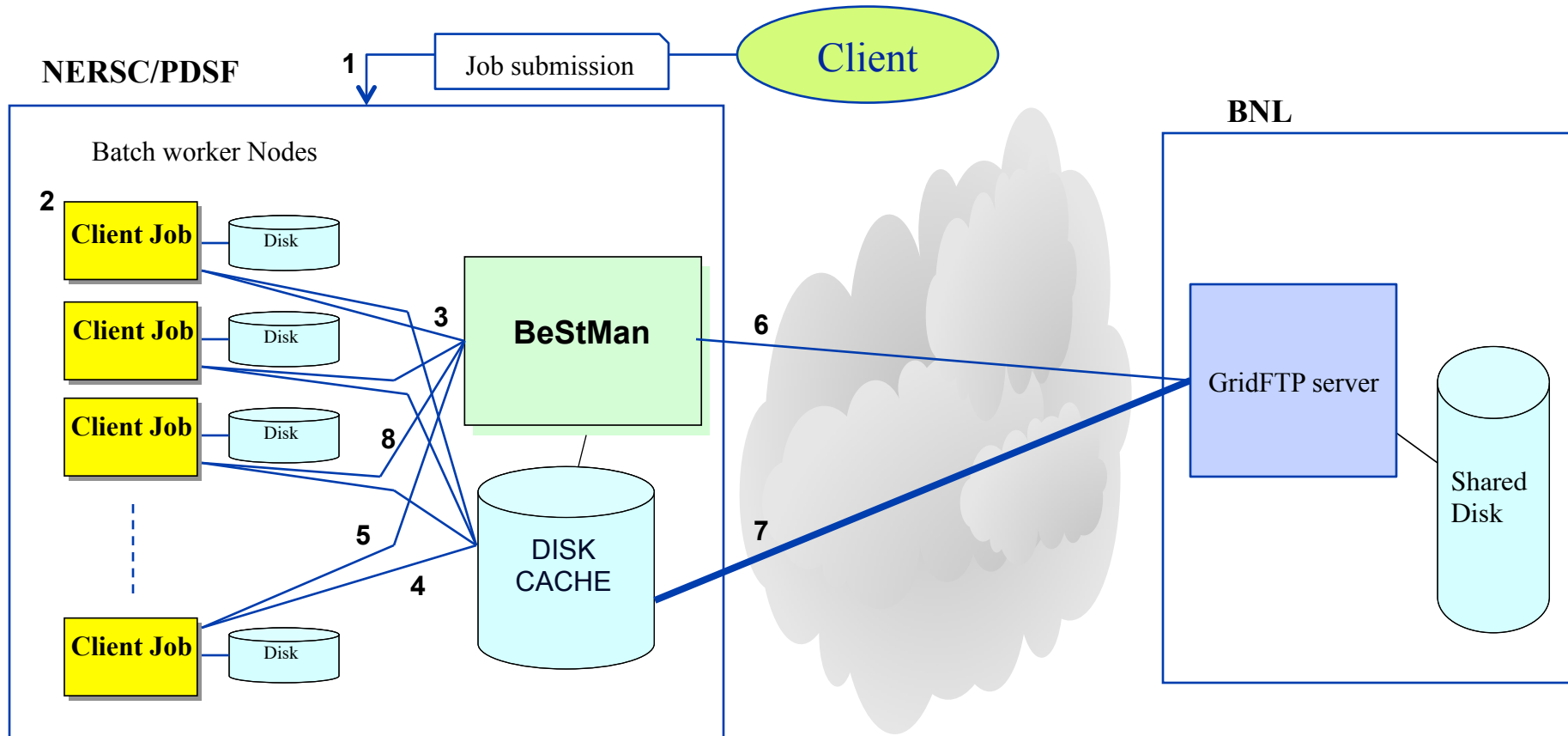
- **BeStMan server and client tools**
  - are integral part of OSG
  - all BeStMan related funding (and therefore support) ends by the end of 2011.
  - need funding in order to continue support and maintenance of all BeStMan related products.

- **Questions**
  - srm@lbl.gov